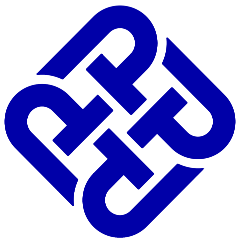

THE HONG KONG POLYTECHNIC UNIVERSITY

Department of Mechanical Engineering

Doctor of Philosophy (PhD) /
Master of Philosophy (MPhil)

(Programme code: 43601)

Programme Booklet (2020/21)

August 2020

Content **Page**

This Programme Booklet is subject to review and changes by the Department from time to time. Students will be informed of the changes as and when appropriate.

This document should be read together with the "Handbook for Research Postgraduate Studies" and the "Research Student Handbook" available at http://www.polyu.edu.hk/ro/STDHBK/.

1. GENERAL INFORMATION

1.1 Programme Titles

Master of Philosophy in ME with Mechanical Engineering

Doctor of Philosophy in ME with Mechanical Engineering

1.2 Offering Department

Department of Mechanical Engineering

1.3 Final Awards

Doctor of Philosophy (PhD)

Master of Philosophy (MPhil)

1.4 Period of Study and Mode of Attendance

(a) Normal Period of Study

Mode of Study	**MPhil** (Programme Code)	**PhD (**Programme Code)	
		For students with Master's degree containing a significant research component	**For students with a Bachelor's degree**
Full-time	2 Years (43601-FTM)	3 Years (43601-FD)	4 Years (43601-FTD)
Part-time	4 Years (43601-PTM)	6 Years (43601-PD)	8 Years (43601-PTD)

(b) Maximum Period of Study

Mode of Study	**MPhil** (Programme Code)	**PhD** (Programme Code)	
		For students with Master's degree containing a significant research component	**For students with a Bachelor's degree**
Full-time	3 Years (43601-FTM)	5 Years (43601-FD)	6 Years (43601-FTD)
Part-time	5 Years (43601-PTM)	7 Years (43601-PD)	9 Years (43601-PTD)

1.5 Entrance Requirements

(a) General Entrance Requirements

To register for the degree of MPhil, a student must hold:

- A Bachelor's degree with first or second class honours from a recognised university; OR
- Other academic qualifications which are deemed to be equivalent.

To register for the degree of PhD, a student must normally hold a postgraduate degree containing a significant research component, such as a dissertation, conferred by a recognised university.

In exceptional circumstances, applicants other than those stipulated above may be admitted directly to the PhD programme. For example, applicants with a Bachelor's degree with First Class Honours, or the equivalent. Such applicants may be required to pass an examination.

PolyU may accept other equivalent qualifications. The decision is made on an individual basis.

(b) English Language Requirements

The requirements for those who do not have a degree for which English was the language of instruction at a recognised university are:

- An overall score of at least 6.5 in the International English Language Testing System (IELTS); OR
- A Test of English as a Foreign Language (TOEFL) score of 80 or above for the Internet-based test or 550 or above for the paper-based test.

All English language test scores are considered valid for two years after the date of the test.

1.6 Residence Requirements

1.6.1 Residence provides students with an opportunity to become immersed in the intellectual environment of the University. Also included in the residence are periods during which students' research requires off-campus field or non-PolyU laboratory work.

1.6.2 Despite of the mode of study, the residence requirement for an MPhil degree is two regular semesters; and that for a PhD degree is three regular semesters if a relevant research Master's degree is earned prior to entering the programme, but four regular semesters if it is not.

1.6.3 All research postgraduate students must fulfil the residence requirement before thesis submission.

1.6.4 In addition to the residence requirement, full-time research postgraduate students are required to be on campus full-time and consequently in such geographical proximity as to be able to participate fully in University activities associated with the programme.

1.6.5 Where a student needs to conduct his/her research outside Hong Kong, adequate supervision arrangements must be proposed by the Chief Supervisor and approved by the Departmental Research Committee (DRC) for study periods spent outside Hong Kong.

1.7 Leave

1.7.1 With the prior agreement of the Chief Supervisor, a full-time student may take vacation leave of up to four weeks per study year. For students who receive financial assistantship under the Teaching Postgraduate Studentship Scheme, the application for leave will have to be approved by the Head of Department (HoD).

1.7.2 Students' application for leave of absence shall be approved by the Chief Supervisor. The Departments must keep the leave record of each of their on-going students and present it to the Research Office when students submit their thesis for examination.

1.8 Confirmation of Registration

1.8.1 A successful applicant should first be registered provisionally for the degree of MPhil or PhD.

1.8.2 Students are required to have their registration confirmed, subject to a formal assessment, according to the normal deadlines as stipulated below:

Study mode	Normal period of study	Deadline for Confirmation of Registration
Full-time PhD	4 years	At the end of the first 6 semesters
Full-time PhD	3 years	At the end of the first 5 semesters
Full-time MPhil	2 years	At the end of the first 3 semesters
Part-time PhD	8 years	At the end of the first 12 semesters
Part-time PhD	6 years	At the end of the first 9 semesters
Part-time MPhil	4 years	At the end of the first 6 semesters

1.8.3 Application for extension of confirmation of registration would only be considered on medical grounds. Medical proof must be attached to the application for the approval of the DRC Chair.

1.8.4 Students failing to have their registration confirmed by the deadline will be de-registered from the Research Postgraduate programme immediately.

2. RATIONALE, AIMS AND INTENDED LEARNING OUTCOMES OF THE PROGRAMME

2.1 University Overarching Aims of Research Degree Programmes

The research degree programmes are designed in such a way to enable the student to:

- acquire competence in research methods and scholarship; and
- display sustained independent effort and independent original thought.

The PhD programmes also target to produce academics, researchers or industrial R & D professionals.

2.2 Learning Outcomes for PhD Programme of the Institution and Department of Mechanical Engineering

Institutional Learning Outcomes for PhD programme	Intended Learning Outcomes of PhD programme in Department of Mechanical Engineering
Research and Scholarship Excellence PhD graduates of PolyU should demonstrate state-of-the-art expertise and knowledge in their area of study, possessed superior competence in research methodologies and contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis. They should also be able to disseminate/communicate their research ideas and findings effectively and efficiently in publications, conferences and classrooms.	**Research and Scholarship Excellence** PhD graduates of ME should (1) exhibit the skills and knowledge to develop original ideas of significance in engineering science to analyze, understand and design intricate engineering problems; (2) develop the ability to disseminate and promote research outputs in a professional manner; (3) prepare for academic or senior position in industry.
Originality PhD graduates of PolyU will be able to think out of the box. They will be innovative problem solvers with excellent mastery of critical and creative thinking methodologies. They will create original solutions to issues and problems pertaining to their area of expertise and the society in general.	**Originality** PhD graduates of ME will be able to think out of the box. They will be innovative problem solvers with excellent mastery of critical and creative thinking methodologies. They will create original solutions to issues and problems pertaining in the area of ME disciplines and the society in general.
Lifelong Learning Capability PhD graduates of PolyU will demonstrate the ability to engage in an enduring quest for knowledge and an enhanced capability for continual academic/professional development through self-directed research in their area of study.	**Lifelong Learning Capability** PhD graduates of ME will demonstrate the ability to engage in an enduring quest for knowledge and an enhanced capability for continual academic/professional development through self-directed research in the area of ME disciplines.

2.3 Leaning Outcomes for MPhil Programme of the Institution and Department of Mechanical Engineering

Institutional Learning Outcomes for MPhil programme	Intended Learning Outcomes of MPhil programme in Department of Mechanical Engineering
Research and Scholarship Excellence MPhil graduates of PolyU should demonstrate advanced competence in research methods, possess in-depth knowledge and skills in their area of study and attain the ability to apply their knowledge and act as leaders in analyzing and solving identified issues and problems in their area of study. They should also be able to disseminate/communicate effectively their research findings in publications, conferences and classrooms.	**Research and Scholarship Excellence** MPhil graduates of ME should (1) demonstrate the ability to enhance and apply advanced knowledge to solve complex engineering problems; (2) develop the ability to disseminate the research outputs in a professional manner (3) prepare for advanced study (such as PhD) or for industry position.
Originality MPhil graduates of PolyU will be versatile problem solvers with good mastery of critical and creative thinking methodologies. They can generate practical and innovative solutions to problems in their area of study.	**Originality** MPhil graduates of ME will be versatile problem solvers with good mastery of critical and creative thinking methodologies. They can generate practical and innovative solutions to problems in their area of ME disciplines.
Lifelong Learning Capability MPhil graduates of PolyU will have an enhanced capability for continual professional development through inquiry and reflection on knowledge in their area of study.	**Lifelong Learning Capability** MPhil graduates of ME will have an enhanced capability for continual professional development through inquiry and reflection on knowledge in the area of ME disciplines.

3. PROGRAMME STRUCTURE

3.1 University Coursework Requirements

Programme	Credit Requirements	Details
Full-time and Part-time MPhil	9 credits	1 credit from HTI6081 + 2 credits from attending seminars + 6 credits from other subjects (no more than 3 credits from Guided-study subjects)
3-year full-time/ 6-year part-time PhD	15 credits	1 credit from HTI6081 + 3 credits from attending seminars + 2 credits from Practicum + 9 credits from other subjects (no more than 6 credits from Guided-study subjects)
4-year full-time/ 8-year part-time PhD	22 credits	1 credit from HTI6081 + 4 credits from attending seminars + 2 credits from Practicum + 15 credits from other subjects (no more than 9 credits from Guided-study subjects)

3.2 Programme Structure: Coursework credit and thesis requirements

3.2.1 Coursework credits of MPhil

Mode and level	Subject (number of credits)	Compulsory/ Elective	Credit
MPhil 2-year Full-time/ 4-year Part-time	ELC6001 Presentation Skills for Research Students* ELC6002 Thesis Writing for Research Students* HTI6081 Ethics: Research, Professional & Personal Perspectives (1)	Compulsory	1
	ME6001 Research Seminars I (1) ME6002 Research Seminars II (1)	Compulsory	2
	ME6602 Computer Simulation Methods in Science and Engineering (3) or ME6603 Advanced Mathematics of Physics and Modern Engineering (3)	Compulsory	3
	ME6101 Advanced Theory and Methods in Vibration Analysis (3) or ME6102 Advanced Topics in Control, Acoustics, and Dynamics (3) or ME6301 Properties, Applications and Modeling of Advanced Materials (3) or ME6302 Solid Mechanics (3) or ME6401 Combustion Science (3) or ME6402 Advanced Fluid Mechanics	Compulsory	3
			Total: 9 Credits

* All research students admitted in or after the 2018/19 cohort shall be required to take and pass these two non-credit bearing English enhancement subjects before thesis submission. For exemption, research students need to pass the Research Language Skills Assessment (RLSA).

3.2.2 Coursework credits of 3-year full-time/6-year part-time PhD

Mode and level	Subject (number of credits)	Compulsory/ Elective	Credit
PhD 3-year Full-time/ 6-year Part-time	ELC6001 Presentation Skills for Research Students* ELC6002 Thesis Writing for Research Students* HTI6081 Ethics: Research, Professional & Personal Perspectives (1)	Compulsory	1
	ME6001 Research Seminars I (1) ME6002 Research Seminars II (1) ME6003 Research Seminars III (1)	Compulsory	3
	ME6006 Practicum I (1) ME6007 Practicum II (1)	Compulsory	2
	ME6602 Computer Simulation Methods in Science and Engineering (3) or ME6603 Advanced Mathematics of Physics and Modern Engineering (3)	Compulsory	3
	ME6101 Advanced Theory and Methods in Vibration Analysis (3) or ME6102 Advanced Topics in Control, Acoustics, and Dynamics (3) or ME6301 Properties, Applications and Modeling of Advanced Materials (3) or ME6302 Solid Mechanics (3) or ME6401 Combustion Science (3) or ME6402 Advanced Fluid Mechanics	Compulsory	3
	Free elective subjects offered to research degree students within or outside PolyU at level 6 or above, subject to the approval of the chief supervisor.	Elective	3
			Total: 15 Credits

* All research students admitted in or after the 2018/19 cohort shall be required to take and pass these two non-credit bearing English enhancement subjects before thesis submission. For exemption, research students need to pass the Research Language Skills Assessment (RLSA).

3.2.3 Coursework credits of 4-year full-time/8-year part-time PhD

Mode and level	Subject (number of credits)	Compulsory/ Elective	Credit
PhD 4-year Full-time/ 8-year Part-time	ELC6001 Presentation Skills for Research Students* ELC6002 Thesis Writing for Research Students* HTI6081 Ethics: Research, Professional & Personal Perspectives (1)	Compulsory	1
	ME6001 Research Seminars I (1) ME6002 Research Seminars II (1) ME6003 Research Seminars III (1) ME6004 Research Seminars IV (1)	Compulsory	4
	ME6006 Practicum I (1) ME6007 Practicum II (1)	Compulsory	2
	ME6602 Computer Simulation Methods in Science and Engineering (3) or ME6603 Advanced Mathematics of Physics and Modern Engineering (3)	Compulsory	3
	ME6101 Advanced Theory and Methods in Vibration Analysis (3) or ME6102 Advanced Topics in Control, Acoustics, and Dynamics (3) or ME6301 Properties, Applications and Modeling of Advanced Materials (3) or ME6302 Solid Mechanics (3) or ME6401 Combustion Science (3) or ME6402 Advanced Fluid Mechanics	Compulsory	3
	Free elective subjects offered to research degree students within or outside PolyU at level 6 or above, subject to the approval of the chief supervisor.	Elective	9
			Total: 22 Credits

* All research students admitted in or after the 2018/19 cohort shall be required to take and pass these two non-credit bearing English enhancement subjects before thesis submission. For exemption, research students need to pass the Research Language Skills Assessment (RLSA).

3.3 Grading

All of the subjects taken will be assigned a grade and a numeral grade point is assigned to each subject grade, as follows:

Grade	Grade Point	Description
A+	4.3	Excellent
A	4	
A-	3.7	
B+	3.3	Good
B	3	
B-	2.7	
C+	2.3	Satisfactory
C	2	
C-	1.7	
D+	1.3	Pass
D	1	
F	0	Failure

3.4 Thesis Requirements

3.4.1 On completion of an approved programme of study and research, students must submit a thesis and defend it in an oral examination.

3.4.2 MPhil and PhD theses shall consist of the student's own work of his investigations and be integrated and coherent piece of work.

3.4.3 Students are required to complete the coursework credit requirements before submission of their thesis for examination. All MPhil and PhD students need to complete their coursework with a qualifying GPA of 2.7 or above before submission of their thesis for examination.

3.5 Relationship between the Programme Outcomes and Subjects

Programme Outcomes	Thesis	HTI6081 Ethics: Research, Professional & Personal Perspectives	ME6001 — ME6004 Research Seminar I - IV	ME6006 — ME6007 Practicum I - II	ME6602 Computer Simulation Method in Science & Engineering	ME6603 Advanced Mathematics of Physics and Modern Engineering	ME6401 Combustion Science	ME6402 Advanced Fluid Mechanics	ME6101 Advanced Theory and Methods in Vibration Analysis	ME6102 Advanced Topics in Control, Acoustics, and Dynamics	ME6301 Properties, Applications and Modeling of Advanced Materials	ME6302 Solid Mechanics	Free elective subjects
PhD													
To exhibit the skills and knowledge to develop original ideas of significance in engineering science to analyze, understand and design intricate engineering problems.	√		√	√	√	√	√	√	√	√	√	√	√
To develop the ability to disseminate and promote research outputs in a professional manner.	√		√	√	√	√	√	√	√	√	√	√	√
To prepare for academic or senior position in industry.	√	√	√	√	√	√	√	√	√	√	√	√	√
To be able to think out of the box and be innovative problem solvers with excellent mastery of critical and creative thinking methodologies and create original solutions to issues and problems pertaining in the area of ME disciplines and the society in general.	√	√	√	√	√	√	√	√	√	√	√	√	√
To be able to demonstrate the ability to engage in an enduring quest for knowledge and an enhanced capability for continual academic/professional development through self-directed research in the area of ME disciplines.	√	√	√	√	√	√	√	√	√	√	√	√	√

Programme Outcomes		HTI6081	ME6001 — ME6004	ME6006 — ME6007	ME6602	ME6603	ME6401	ME6402	ME6101	ME6102	ME6301	ME6302	
	Thesis	Ethics: Research, Professional & Personal Perspectives	Research Seminar I - IV	Practicum I - II	Computer Simulation Method in Science & Engineering	Advanced Mathematics of Physics and Modern Engineering	Combustion Science	Advanced Fluid Mechanics	Advanced Theory and Methods in Vibration Analysis	Advanced Topics in Control, Acoustics, and Dynamics	Properties, Applications and Modeling of Advanced Materials	Solid Mechanics	Free elective subjects
MPhil				**NA**									**NA**
To demonstrate the ability to enhance and apply advanced knowledge to solve complex engineering problems.	√		√		√	√	√	√	√	√	√	√	
To develop the ability to disseminate the research outputs in a professional manner.	√		√		√	√	√	√	√	√	√	√	
To prepare for advanced study (such as PhD) or for industry position.	√	√	√		√	√	√	√	√	√	√	√	
To be versatile problem solvers with good mastery of critical and creative thinking methodologies. They can generate practical and innovative solutions to problems in their area of ME disciplines.	√	√	√		√	√	√	√	√	√	√	√	
To have an enhanced capability for continual professional development through inquiry and reflection on knowledge in the area of ME disciplines.	√	√	√		√	√	√	√	√	√	√	√	

4. REGULATIONS AND ADMINISTRATIVE PROCEDURES

The academic regulations governing the operation and assessment of all research degree programmes can be found in the "Handbook for Research Postgraduate Studies" and the "Research Student Handbook" available at http://www.polyu.edu.hk/ro/STDHBK/. Some regulations are extracted and presented in the following sections.

4.1 GPA Requirement

4.1.1 All MPhil and PhD students need to complete their coursework with a qualifying GPA of 2.7 or above before submission of their thesis for examination.

4.1.2 The qualifying GPA is the result of the accumulated value of the subject grade point multiplied by the subject credit value divided by the total credit value for those subjects. It is computed as follows:

$$\text{Qualifying GPA} = \frac{\sum \text{Subject Grade Point x Subject Credit Value}}{\sum \text{Subject Credit Value}}$$

Where
a) credits earned from all compulsory subjects, except those assessed with a "Pass" or "Fail" grade (such as Practicum anf Seminars), will be included in the calculation of Qualifying GPA;

b) The best grade point will be chosen for the calculation of the Qualifying GPA for credits earned for elective subjects;

c) the following subjects will be excluded from the calculation of Qualifying GPA:
   (i) exempted subjects
   (ii) ungraded subjects
   (iii) incomplete subjects
   (iv) subjects for which credit transfer has been approved, but without any grade assigned
   (v) subjects from which a student has been allowed to withdraw (i.e. those with the grade "W")

4.1.3 Students may take more subjects than required in order to improve their GPA or in order to strengthen their knowledge.

4.1.4 Subjects taken after submission of the thesis will not contribute to the qualifying GPA.

4.1.5 Students may only retake a subject which they have failed (i.e. Grade F or U), and the number of retakes is restricted to a maximum of two.

4.1.6 The second retake of a failed subject requires the approval of the Faculty/School Board Chairman.

4.1.7 Students who have failed a compulsory subject after two retakes will be deregistered.

4.1.8 In cases where a student takes another subject to replace a failed elective subject, the fail grade will be taken into account in the calculation of the GPA, despite the passing of the replacement subject.

4.1.9 A student may be exempted from taking a compulsory subject if s/he has successfully completed a similar subject previously in another programme or if s/he already has the associated knowledge/skills via work experience, etc. Subject exemption is decided by the DRC but students can also apply for it. In order to satisfy the credit requirement, it is necessary for the student to take another subject, to be approved by the Chief Supervisor, in place of the exempted subject. Such subject will be considered as an elective subject.

4.1.10 The grades obtained by research students on coursework subjects, including Practicum and Seminars, will be considered and endorsed by the Subject Assessment Review Panel (SARP) of the department offering the subject. The grades obtained by the research students on Guided-study subjects will be considered and endorsed by the relevant DRC based on the assessment reports (Form RC/27).

4.1.11 Unless specified otherwise, University's General Assessment Regulations (GAR) for credit-based programmes should also apply to the RPg programme.

4.2 Credit Transfer

4.2.1 Credits which have already been used to contribute to a previous award should not be transferred to contribute to the MPhil/PhD award with the following exceptions:

(a) All returning students will be allowed to transfer the grade obtained in the subject "HTI6081 Ethics: Research, Professional & Personal Perspectives" to the new RPg programme regardless of its level, provided that the grade was attained within five years of re-admission;

(b) All 3-year full-time/6-year part-time PhD students will be allowed to transfer one credit from his/her previous attendance in seminars.

4.2.2 *Transfer of credits of subjects at postgraduate level earned from recognised previous studies*

Applications for the transfer of credits from recognised previous studies will be endorsed by the DRC with justifications and approved by the HoD. Only credits gained from subjects at postgraduate level that have not been used to contribute to an award will be acceptable for transfer. The validity period for such credit transfer for research degree programmes is defined to be eight years from the year of attainment at the time of admission. The maximum number of credits transferrable for different categories of students is:

No more than 50% of the credit requirement of the programme disregarding whether the credits were earned within or outside PolyU.

Credits transferred from previous study outside the University will not be included in the calculation of the qualifying GPA.

4.2.3 *Transfer of credits taken at postgraduate level outside PolyU after admission*

Taking subjects outside PolyU during the student's research postgraduate studies in PolyU with prior approval is regarded as an acceptable way to gain credits. The student should submit an

application (Form RC/48), via his/her Chief Supervisor, to the Department to initiate the transfer. The application will be endorsed by the DRC Chair and approved by the HoD.

The transfer of grades will be in accordance with the conversion table below and the grade gained will be included in the calculation of the qualifying GPA:

Grade Obtained Outside PolyU after Admission	**Grade Transferred to PolyU**	**Grade Point**	**Interpretation**
A+	A+	4.3	Excellent
A	A	4	
A-	A-	3.7	
B+	B+	3.3	Good
B	B	3	
B-	B-	2.7	
C+	C+	2.3	Satisfactory
C	C	2	
C-	C-	1.7	
D+	D+	1.3	Pass
D	D	1	
D-	D	1	
E	F	0	Failure
F	F	0	

4.2.4 Minimum number of credits with a letter grade

An MPhil student must complete a least three credits with a letter grade and a PhD student at least six to allow for a meaningful calculation of the qualifying GPA.

4.3 Subject Registration

4.3.1 Research students will register for subjects at the same time as other students. Whether a research student can add a subject will depend on the availability of vacancies in the subject and the approval of the Chief Supervisor. Similarly, a student can drop a subject if it is approved by the Chief Supervisor. The student will effect the subject registration/deletion via eStudent platform.

4.3.2 Dropping of subjects after the add/drop period is not allowed. If a student has a genuine need to drop a subject after the add/drop period, it will be handled as withdrawal of subject. The student should submit an application for withdrawal of subject to the Chief Supervisor and Subject Lecturer for approval. The withdrawn subject will be reported in the Assessment Result Notification and Transcript of Studies although it will not be counted in the calculation of QGPA.

4.3.3 Application for withdrawal of subject will not be entertained after the commencement of examination period.

4.4 Guide-study Subjects

Guided-study subjects are those in which normally no lecturing is done and in which the student is required by the subject supervisor to read specified monographs and journal publications; the student and subject supervisor frequently meet to discuss the progress made by the student in the subject. The weighting assigned for coursework should be less than the weighting assigned for the examination. Coursework normally consists of assignments and presentations. Examination is compulsory and normally includes both written and oral. At the end of the semester, the student is examined by the subject supervisor and another staff member who is knowledgeable about the topic. A grade will be given in the same way as for regular taught subjects in Form RC/27. All Guided-study subjects will be at level 6 and their code number will be between 6800 and 6999.

4.5 Progress Report

All students will be assessed by their academic department by the end of each Semester. DRC is required to indicate in the Student Record System if an RPg student will be allowed to proceed on with their study by end of each Semester.

4.6 Deregistration

4.6.1 A student may be deregistered in the following circumstances:

a) if his/her progress is considered unsatisfactory; or

b) if the maximum period of study is exceeded; or

c) if his/her thesis is deemed unsatisfactory.

4.6.2 A recommendation for deregistration as a result of unsatisfactory progress may be proposed by the Chief Supervisor and approved by the DRC. The DRC Chairman cannot take action by himself/herself on this issue.

4.6.3 A recommendation for deregistration made by the Board of Examiners (BoE) shall be approved or rejected by the Research Committee.

5. SUBJECT SYLLABI

The syllabi of subjects offered by Department of Mechanical Engineering are presented in the subsequent pages by alphabetical order of subject codes.

ME6001-4	Research Seminar I, II, III and IV
ME6006-7	Practicum I and II
ME6101	Advanced Theory and Methods in Vibration Analysis
ME6102	Advanced Topics in control, Acoustics, and Dynamics
ME6301	Properties, Applications and Modeling of Advanced Materials
ME6302	Solid Mechanics
ME6401	Combustion Science
ME6402	Advanced Fluid Mechanics
ME6602	Computer Simulation Methods in Science and Engineering
ME6603	Advanced Mathematics of Physics and Modern Engineering

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Subject Description Form

Subject Code	ME6001 ME6002 ME6003 ME6004
Subject Title	Research Seminar I Research Seminar II Research Seminar III Research Seminar IV
Credit Value	One credit per subject
Level	6
Pre-requisite/ Co-requisite/ Exclusion	N.A.
Objectives	To let the students to meet with leaders of different research fields and broaden their exposure to and knowledge of latest research and technology.
Intended Learning Outcomes	a. To develop substantial fundamentals and state-of-art technologies in ME discipline; b. To broaden their exposure to other disciplines so as to help developing in-depth understanding and specialize one or more research methodologies and techniques in ME discipline; c. To develop the ability to pose scientific problems in Mechanical Engineering; d. To develop the ability to disseminate and promote research outputs in a professional manner.
Subject Synopsis/ Indicative Syllabus	To be arranged in line with the departmental seminars.
Teaching/Learning Methodology	Full-time students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year. Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years. The research seminars may or may not be organised by the host department and are expected to last not less than an hour each. The topic of the seminar reported on should not be related directly to the thesis title of the student. Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to the Research Office for custody at the end of each academic year.

<table>
<tr><td></td><td>Students should be awarded one credit per year (for full-time students) or per two years (for part-time students) for completing the above-mentioned requirement, with an overall assessment grade of Pass and Fail.

The total credits need to be earned by students are listed as follows:

The total credits need to be earned by students are listed as follows:

2-year MPhil student needs to take Research Seminar I and II (2 credits in total)
3-year PhD student needs to take Research Seminar I, II and III (3 credits in total)
4-year PhD student needs to take Research Seminar I, II, III and IV (4 credits in total)</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td></tr>
<tr><td>Attendance</td><td>50%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>No less than 1,500 words report</td><td>50%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
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<tr><td>Reading List and References</td><td>N/A</td></tr>
</table>

July 14

Subject Description Form

Subject Code	ME6006 ME6007
Subject Title	Practicum I Practicum II
Credit Value	1 credit per subject
Level	6
Pre-requisite/ Co-requisite/ Exclusion	N.A.
Objectives	This subject is compulsory for PhD students. Aims to provide teaching experience and training opportunity to research students in order to widen their exposure for the development of their academic career.
Intended Learning Outcomes	a. To develop substantial fundamentals and state-of-art technologies in ME discipline; b. To broaden their exposure to other disciplines so as to help developing in-depth understanding and specialize one or more research methodologies and techniques in ME discipline; c. To develop the ability to pose scientific problems in Mechanical Engineering; d. To develop the ability to disseminate and promote research outputs in a professional manner
Subject Synopsis/ Indicative Syllabus	The nature of the training shall be related to teaching and research, and be relevant to the formal programme of study.
Teaching/Learning Methodology	The departmental training requirement for stipend recipients should be kept unchanged. As part of the programme requirement, all PhD students, irrespective of funding source and mode of study, **must** complete two training credits before graduation. To earn one credit, students will be required to engage in teaching/research supporting activities assigned by the HoD/DoS or his/her delegate for 6 hours/week in any 13-week semester. Students are allowed to complete these two credits any time before they graduate. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor. Stipend recipients are allowed to fulfill part of their departmental training requirement through the completion of these compulsory training credits. Students who are required to undertake teaching supporting activities~~,~~ are required to complete the training programmes organised by the Educational Development (EDC), English Language Centre/Chinese Language Centre (as required) ~~ and ELC~~ before the commencement of any teaching supporting activities.

Assessment Methods in Alignment with Intended Learning Outcomes	At the end of the training session, an assessment report on the performance of the relevant student(s), with details of activities undertaken and an overall assessment grade of Pass or Fail.	
Student Study Effort Expected	The duties normally include: - Assistance with running of tutorials/seminars/workshops, and/or supervision of laboratory or practical work; - Assistance with grading of tests, assignments and examination papers; - Assistance with preparation of materials and resources for supporting teaching and learning; - Assistance with invigilation of University degree examinations; and - Assistance with other teaching and administrative duties, as deemed appropriate by the department.	6 hours/week in any 13-week semester.
Reading List and References	To be advised by the subject offering lecturers.	

Revised March 2019

Subject Description Form

Subject Code	ME6101
Subject Title	Advanced Theory and Methods in Vibration Analysis
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Exclusion: ME536 Vibrations and Structure-borne Noise
Objectives	The subject aims: 1. To equip students with the knowledge of MDOF systems; 2. To introduce students with elements of analytical dynamics; 3. To introduce students with continuous models and advanced analysis methods.
Intended Learning Outcomes	Upon satisfactory completion of the subject, students are expected to achieve the following outcomes: a. Able to understand and formulate the dynamic response of MDOF systems; b. Able to apply their knowledge of vibration theory and methods to model mechanical behavior and conduct modal analysis; c. Able to conduct analysis and design in sound and vibration systems with advanced analysis methods; d. Able to comprehend the theoretical aspects in the related literature.
Subject Synopsis/ Indicative Syllabus	***Introduction to Vibrations*** **-** Equivalent springs, dampers and masses; Nature of Excitations, and vibration about equilibrium points; Response of SDOF systems to nonPeriodic Excitations; Whirling of rotating shafts; Vibration isolation, energy dissipation and structural damping. ***Elements of Analytical Dynamics*** **-** Degree of freedom and generalized coordinates; The principle of virtual work and D'Alembert; The hamilton's principle; Lagrange's equations. ***Multi DOF Systems*** **-** Properties of the stiffness and Mass coefficients; Linear transformations – coupling; The eigenvalue problem; Orthogonality of modal vectors; Modal analysis. ***Continuous Models for Vibrations*** **-** Transverse vibration of strings; Vibration of beams; Vibration of plates; Wave Equation. ***Advanced Selective Topics*** **-** Advanced acoustics; Wave propagation and application; Nonlinear analysis methods (perturbation, harmonic balance, or Volterra series etc).
Teaching/Learning Methodology	Lectures and Tutorials

<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td></tr>
<tr><td>1. Continuous Assessment</td><td>40%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Final</td><td>60%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
</table>

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture (13 weeks and 3 hrs per week)</td><td>39 Hrs.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Precepts or Tutorials</td><td>26 Hrs.</td></tr>
<tr><td>▪ After-class reading</td><td>39 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>104 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>1. Leonard Meirovitch, Fundamentals of Vibrations, McGraw Hill, latest edition.
2. Haym Benaroya, Mechanical vibration, Prentice Hall, latest edition.</td></tr>
</table>

Jan 15

Subject Description Form

Subject Code	ME6102
Subject Title	Advanced Topics in Control, Acoustics, and Dynamics
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To equip students with the knowledge of advanced control and learning systems. 2. To equip students with the knowledge of advanced acoustics. 3. To equip students with the knowledge of advanced wave theory.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) Synthesise feedback control methods for automating various systems and machines. b) Design computing algorithms for learning models and recognising patterns in signals. c) Model acoustic wave generation, propagation, reflection, scattering and absorption in various media. d) Apply the conceptual and theoretical acoustics knowledge to analyse acoustical problems. e) Apply the wave propagation theory to simulation, analyse and solve problems of wave propagation. f) Design non-destructive evaluation approaches using guided waves.
Subject Synopsis/ Indicative Syllabus	**Module 1. Control and Learning Systems**. • **Systems Modelling.** Discrete/continuous-time systems; Linear/non-linear systems; Energy-based dynamics; Differential kinematic systems. • **Control Systems.** Feedback signals; Lyapunov stability; LQ-based control; Model-based nonlinear control; Adaptive sensor servoing; • **Learning Systems.** Connectionist models; Backpropagation; Recurrent NN; Reinforcement learning; Hebbian learning; Self-organising maps. **Module 2. Advanced Acoustics** • **Fluid Acoustics.** Dynamics of fluid motion; Acoustic wave motion; Acoustics in moving media; Green's function; Internal energy loss. • **Acoustical System Coupling.** Systems of infinite extent; Finite panel; Periodically supported systems; Coupled cavities. • **Non-linear Acoustics.** Non-linear steepening; Harmonic equation of acoustic waves; Weak-shock theory; Anomalous energy dissipation. **Module 3. Elastic Wave Propagation in Solids: Linear and Nonlinear Aspects**

<table>
<tr><td></td><td>

- **Fundamental Theory.** Dispersion; Waves in layered plates and hollow cylinders; waves in viscoelastic medium.
- **Modelling Waves.** Analytical solutions; semi-analytical finite element method; modeling wave propagation.
- **Nonlinear Method.** Bulk waves in weakly nonlinear elastic medium; second harmonic generation; Weakly nonlinear wave equation.
- **Study Extension**. Phased array; imaging.

</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Lectures and Tutorials</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>1. Continuous Assessment</td><td>50%</td><td>✔</td><td>✔</td><td>✔</td><td>✔</td><td>✔</td><td>✔</td></tr>
<tr><td>2. Examination</td><td>50%</td><td>✔</td><td>✔</td><td>✔</td><td>✔</td><td>✔</td><td>✔</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
1. The assessment is comprised of 50% continuous assessment and 50% examination.
2. The continuous assessment aims at evaluating the progress of students study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.
3. The examination is used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>33 Hrs.</td></tr>
<tr><td>▪ Tutorials</td><td>6 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignments</td><td>28 Hrs.</td></tr>
<tr><td>▪ Self-learning</td><td>39 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>106 Hrs.</td></tr>
</table>
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</table>

Reading List and References	1. Lecture Notes 2. Darryl D. Holm, Geometric Mechanics and Symmetry From Finite to Infinite Dimensions, Latest Edition 3. Jean-Jaques Slotine, Applied Nonlinear Control, First Edition 4. Simon Haykin, Neural Networks and Learning Machines, Latest Edition 5. Philip Morse, Uno Ingard, Theoretical Acoustics, Latest Edition 6. Fabien Anselmet, Pierre-Olivier Mattei, Acoustics, Aeroacoustics and Vibrations, Latest Edition 7. Joseph Rose, Ultrasonic Guided Waves in Solid Media, Cambridge University Press, Latest Edition

(Implemented from 2019/20 academic year.)

March 2019

Subject Description Form

Subject Code	ME6301
Subject Title	Properties, Applications and Modeling of Advanced Materials
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	N.A.
Objectives	To provide students with theories, properties, applications and modeling methods of advanced composite materials, smart materials, and nano-materials.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. understand the mechanics of advanced composite materials, especially the mechanics of a lamina and laminates, including failure mechanisms; b. possess the state-of-the-art knowledge on smart materials and smart structure design; c. recognize the importance of nano-materials in advanced technology; and d. understand the applications of advanced composites, smart materials and nano-materials. e. understand advanced theories in mechanics of solids.
Subject Synopsis/ Indicative Syllabus	***Advanced Composite Materials*** **-** Composite constituents; principles of fibre-reinforced composites; mechanics of a lamina; mechanics of laminates, tooling and manufacturing processes; failure criteria for composites; design issues. ***Selected Topics of Advanced Theories in Mechanics of Solids*** **-** such as Theory of Plasticity, Theory of Fracture Mechanics. ***Piezoelectric Materials*** - The fundamental mechanisms of piezoelectric materials and major applications, Curie temperature, concept of piezoelectric moduli and applications of these moduli in design of sensors and actuators, smart structure design issues. ***Shape Memory Alloys (SMA)*** **-** Phenomena & mechanisms of temperature controlled shape memory effect, critical temperatures, stress effect on critical temperatures, mechanical properties of SMA at different phases and temperatures, shape memory and superelasticity, modeling of the effects of temperature and stress, special design considerations at joints, continuum vs. discrete applications of SMA, major applications of SMA. ***Nanomaterials*** **-** properties, applications and modeling of nano-materials. ***Laboratory Works:*** • Mechanical properties of shape memory alloys. • Strain measurement of composite structures using embedded fibre-optic sensors.

Teaching/Learning Methodology

1. The teaching and learning methods include lectures/tutorial sessions, homework assignments, test, mini-project or case study and examination.

2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for advanced materials and structural design.

3. Technical/practical examples and problems are raised and discussed in class/tutorial sessions.

Teaching/Learning Methodology	Intended subject learning outcomes				
	a	b	c	d	e
1. Lectures	√	√	√	√	√
2. Tutorials	√	√	√	√	√
3. Homework assignments	√	√		√	√
4. Mini-project/Case study report and presentation		√	√	√	

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Homework assignments	15%	√	√		√	√
2. Mid-term test	25%	√				√
3. Mini-project/Case study report and presentation	10%		√	√	√	√
4. Examination	50%	√	√	√	√	√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

1. The assessment is comprised of 50% continuous assessment and 50% examination.

2. The continuous assessment consists of three components: homework assignments, mid-term test, mini-project or case study report & presentation. They are aimed at evaluating the progress of students study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.

3. The examination is used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial/Lab	6 Hrs.
	Other student study effort:	
	▪ Self Study	45 Hrs.
	▪ Mini-project/Case study report preparation and presentation	21 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Alan Baker, Stuart Dutton and Donald Kelly, *Composite Materials for Aircraft Structures*, AIAA, latest edition. 2. Ronald F. Gibson, *Principles of Composite Material Mechanics*, McGRAW-HILL, latest edition. 3. Srinivasan A. V. and McFarland D. M., *Smart Structures*, Cambridge University Press, latest edition. 4. Banks H. T., Smith R. C. and Wang Y., *Smart Material Structures*, John Wiley & Sons, latest edition. 5. Nanostructured Materials - Processing, Properties, and Applications, edited by Carl C. Koch, William Andrew Publishing, latest edition. 6. T.L. Anderson, *Fracture Mechanics: fundamentals and applications*, CRC Press Inc., latest edition. 7. A.S. Khan and S.J. Huang, *Continuum Theory of Plasticity*, John Wiley & Sons Inc., latest edition.	

July 14

Subject Description Form

Subject Code	ME6302
Subject Title	Solid Mechanics
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Prerequisite: Students should have basic knowledge in Calculus, Linear Algebra, Engineering Materials, and Mechanics of Materials.
Objectives	To provide students with knowledge of mathematical treatments of small and large deformation, constitutive relations, elasticity, plasticity, fracture mechanics.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the mathematical treatment of linear and non-linear mechanical behaviour of materials. b. Understand the broad applications of advanced theories in various engineering problems. c. Recognize the frontier of research in solid mechanics.
Subject Synopsis/ Indicative Syllabus	**Elasticity:** Stress and strain in 3D space and their tensor representations**,** theory for small deformation and large deformation, tensor analysis, viscoelasticity, rubber elasticity, contact mechanics, micromechanics. **Plasticity:** Yield criteria, Convexity of yield surface and the associated flow rule, Bauschinger effect and back stress, Incremental theories of plasticity, Slip-Line Field Solutions, Crystal plasticity. **Fracture Mechanics:** Stress intensity factor K, Energy release rate**,** Griffith theory, criterion for brittle materials, J-Integral. **Finite element modelling**: Constitutive models and user subroutine, Implicit and Explicit methods.

Teaching/Learning Methodology

1. The teaching and learning methods include lectures, laboratory sessions, homework assignments, test, mini-project, and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for advanced topics in solid mechanics.
3. Technical/practical examples and problems are raised and discussed in class.
4. The mini project could be a numerical simulation project or literature survey on a given topic.

Teaching/Learning Methodology	Intended Subject Learning Outcomes		
	a	b	c
1. Lecture	√	√	√
2. Homework assignment	√	√	
3. Mini-project	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Homework assignment	20%	√	√	
2. Test	20%	√	√	
3. Mini-project	20%	√	√	√
4. Examination	40%	√	√	
Total	100 %			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:
$0.40 \times$ End of Subject Examination + $0.60 \times$ Continuous Assessment

The continuous assessment consists of three components: homework assignments, test, mini-project report & presentation. They are aimed at evaluating the progress of study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.

The examination is used to assess the knowledge acquired by the students

	for understanding and analysing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.	
Student Study Effort Expected	Class contact:	
	• Lecture	39 Hrs.
	Other student study effort:	
	• Self-study	39 Hrs.
	• Mini-project	28 Hrs.
	Total student study effort	106 Hrs.
Reading List and References	1. YC Fung, *Foundations of solid mechanics*, latest edition, Prentice Hall 2. JD Ferry, *Viscoelastic Properties of Polymers*, latest edition, Wiley 3. R Hill, *The Mathematical Theory of Plasticity*, Clarendon Press 4. TL Anderson, *Fracture Mechanics, Fundamentals and Applications*, latest edition, Taylor & Francis, CRC Press *5.* S Nemat-Nasser M Hori, *Micromechanics: Overall Properties of Heterogeneous Materials*, North-Holland 6. K.L. Johnson, *Contact Mechanics*, Cambridge University Press	

(Implemented from 2019/20 academic year.)

March 2019

Subject Description Form

Subject Code	ME6401
Subject Title	Combustion Science
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	N.A.
Objectives	1. To provide fundamental scientific aspects of combustion. 2. To develop sound understanding of relationships among fuels, combustion processes and pollutant emissions. 3. To develop knowledge for the evaluation of combustion, thermal and emission characteristics of a combustion process.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the combustion process between fuels and oxygen, and different types of flame. b. Apply Thermodynamics to solve the energy conversion of a combustion process. c. Apply Chemical Kinetics of Combustion to evaluate the chemical reaction of a combustion process. d. Evaluate the air pollutants formed and emitted during a combustion process. e. Understand the most current trend in combustion science with the main goal to protect the environment.
Subject Synopsis/ Indicative Syllabus	***Fundamentals of Combustion Science*** **-** nature of combustion; premixed and diffusion flames; laminar and turbulent flames; fuel-lean, stoichiometric and fuel-rich combustion; flame stability and flammable limits; open-flame and impingement heat transfer. ***Fuels and Combustion*** **-** gaseous, liquid and solid fuels; fuel properties; air pollutants formed during combustion process; alternative fuels. ***Thermodynamics of Combustion*** **-** combustion stoichiometry; chemical equilibrium and equations; Laws of Thermodynamics applying to combustion process; enthalpy of combustion; Adiabatic flame temperature; calorific value. ***Chemical Kinetics of Combustion*** **-** elementary reactions; chain and global reactions; nitrogen oxide kinetics; soot kinetics; dissociation and equilibrium constants. ***Combustion-led Air Pollution*** **-** carbon oxides and hydrocarbons; sulfur oxides; nitrogen oxides; particulates and soot. ***Current Trend in Combustion for Environmental Protection*** **-** sulfur-free liquid fuels; low-NO_X combustion; bio-fuels; hydrogen; hydrocarbon gaseous fuels enriched with hydrogen.

Teaching/Learning Methodology

Lectures are used to deliver fundamental knowledge in various scientific aspects of combustion.

Seminars are provided by Guest Speakers on most current development in combustion science for the purpose of environmental protection.

Tutorials are used to demonstrate the applications of fundamental knowledge of combustion science.

Laboratory works are used to enhance the understanding of relationships among fuels, combustion processes and pollutant emissions, and provide hands-on experience for their evaluations.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Laboratory Report	15%	√	√	√	√	√
2. Mini Project Report	15%	√			√	√
3. Test	20%	√	√	√	√	√
4. Examination	50%	√	√	√	√	√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment: 0.5 (Examination) + 0.5 (Continuous Assessment)
Continuous Assessment: Laboratory Report + Mini Project Report + Test

Laboratory report will be used to assess the students' understanding of relationships among fuels, combustion processes and pollutant emissions, and their ability to evaluate a combustion process.

Mini project report will be used to assess the students' understanding of relationships among fuels, combustion processes and pollutant emissions, and their ability to explore the most current development in combustion science.

Test and examination will be used to assess the students' overall understanding of the subject and their ability to apply fundamental knowledge at the middle and end of the semester.

Student Study Effort Expected	Class contact:	
	▪ Lectures and Seminars	33 Hrs.
	▪ Tutorials and Laboratory Works	6 Hrs.
	Other student study effort:	
	▪ Mini-project and Laboratory Reports	20 Hrs.
	▪ Assignments	20 Hrs.
	▪ Literature Review and Self-learning	33 Hrs.
	Student study effort expected	112 Hrs.

July 14

Subject Description Form

Subject Code	ME6402
Subject Title	Advanced Fluid Mechanics
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide both fundamental and advanced concepts and methods in fluid mechanics. 2. To introduce the state-of-the-art experimental methods in fluid mechanics.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve flow problems by applying knowledge of fluid mechanics. b. Analyze and interpret data obtained from experimental or computational fluid mechanics. c. Communicate effectively through completing written reports of laboratory experiments. d. Conduct a comprehensive survey on selected topics in fluid mechanics through completing a mini project.
Subject Synopsis/ Indicative Syllabus	***Fundamentals*** – governing equations for Newtonian fluids; some solutions of the Navier-Stokes equations; non-Newtonian fluids; dimensional analysis . ***Irrotational Flows*** – theorems for irrotational flow; potential flow; added mass. ***Boundary Layers*** – introduction to boundary layer; the boundary layer equations; Falkner–Skan similarity solutions; flow separation. ***Flow Stability*** – linear stability theory of fluid flows; Couette-Taylor instability; stability of plane flows. ***Turbulent Flows*** – types of turbulent flows; statistical approach; turbulent models. ***Experimental Fluid Dynamics*** – basic pressure and flow rate measurements; flow visualization; flow velocity measurements.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental and advanced knowledge of fluid mechanics and relevant experimental methods.

Tutorials are used to illustrate the applications of fluid mechanics knowledge.

Laboratory experiments are arranged to relate the concepts to practical applications. Students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results.

A mini project is designed to have students learn how to collect, analyze and summarize up-to-date research information on selected topics in fluid mechanics.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Assignment / Lab Report / Mini Project Report / Test	60%	√	√	√	√
2. Examination	40%	√	√		
Total	100 %				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment: 0.6 (Continuous Assessment) + 0.4 (Examination)
Continuous Assessment: Assignment + Laboratory Report + Mini Project Report + Test

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the assignments, laboratory reports, mini project reports and the test, which provide timely feedbacks to both lecturers and students on various topics in the syllabus.

Student Study Effort Expected

Class contact:	
▪ Lectures	33 Hrs.
▪ Tutorials and Laboratory Experiments	6 Hrs.
Other student study effort:	
▪ Assignments	20 Hrs.
▪ Mini-project and laboratory reports	20 Hrs.
▪ Self-learning	33 Hrs.
Total student study effort	112 Hrs.

Reading List and References	1. W. P. Graebel, Advanced Fluid Mechanics, Elsevier, latest version 2. R. L. Panton, Incompressible Flow, Wiley, latest version 3. G. K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University Press, latest version 4. F. M. White, Viscous Fluid Flow, McGraw-Hill, latest version 5. H. Schlichting, K. Gersten, Boundary-Layer Theory, Springer, latest version 6. S. B. Pope, Turbulent Flows, Cambridge University Press, latest version 7. R. Goldstein, Fluid Mechanics Measurements, CRC Press, latest version

(Implemented from 2019/20 academic year.)

March 2019

Subject Description Form

Subject Code	ME6602
Subject Title	Computer Simulation Methods in Science and Engineering
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	N.A.
Objectives	1. To provide students with different simulation related methodologies in scientific research from different disciplines; 2. To equip students with numerical method technologies to support computer simulation and its realization; 3. To enable the students to apply computer-oriented simulation techniques and methods to solve modern science and engineering research problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Use the numerical methods in solving ordinary differential equations and partial differential equations b. Understand the numerical simulation methods and how simulation is used in the modeling of engineering processes c. Select and apply different simulation methods in modelling of scientific problems in different size scales d. Apply simulation methods to solve practical scientific and engineering problems and provide feasible solutions.
Subject Synopsis/ Indicative Syllabus	***Simulation Methods and fundamentals –*** Random numbers. Probability distributions and correlation functions. Stochastic equations. Brownian motions. Random walks. Statistical ensembles. Statistical calculation of physical quantities. Monte Carlo simulation. Lattice Boltzmann simulation, other simulation methods, Case studies and examples. ***Finite element method –*** Finite element formulation for elastic deformation. Finite element for plastic and visco-plastic deformation. Shape function. Element type and isoparametric element, Numerical integration. Selection of mesh and discretization. Case studies and examples. ***Computational Fluid Dynamics (CFD) –*** Classification of partial differential equations, Navier-Stokes Equations, Grid generation, structured grid, unstructured grid. Turbulence and its modeling. ***Finite Difference Method –*** Finite difference formulations; parabolic partial differential equations, explicit method, implicit method, stability analysis; elliptic equations, solution algorithms; hyperbolic equations, explicit method, implicit method, splitting method. ***Applications of Numerical Simulation –*** Product strength design. Manufacturing process simulation and optimization. Product fatigue life design and analysis. Product damage and fracture analysis and prediction

Teaching/Learning Methodology*)*

The subject will be taught via lectures and tutorials.

Lectures are used to deliver the knowledge of computer simulation methods.

Tutorials will be conducted in small groups to facilitate discussions.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	√
Tutorials	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Assignment	40%	√	√	√	√
2. Test	10%	√	√	√	√
3. Examination	50%	√	√	√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignments will be used to assess students' learning on the mathematics used in computer simulation methods, and on the principles and basic techniques of computer simulation methods.

Tests will be conducted to assess students' learning on fundamental knowledge of computer simulation methods.

Examination will be conducted to assess students' learning on the mathematics used in computer simulation methods, and on the principles of computer simulation methods.

Student Study Effort Expected

Class contact:	
▪ Lectures	27 Hrs.
▪ Tutorials	12 Hrs.
Other student study effort:	
▪ Performing assignments	40 Hrs.
▪ Private study	27 Hrs.
Total student study effort	106 Hrs.

Reading List and References	1. M. P. Allen, and D. J. Tildesley, Computer simulation of liquids, Oxford Science Publications, latest edition. 2. A. R. Leach, Molecular modelling: principles and applications, Prentice Hall, latest edition. 3. Harvey Gould, Jan Tobochnik, and Wolfgang Christian**,** An introduction to computer simulation methods: applications to physical systems, Addison-Wesley, latest edition. 4. K.A. Hoffmann and S.T. Chiang, Computational fluid dynamics for engineers, Engineering education system, latest edition. 5. H. K. Versteeg and W Malalasekera, An introduction to Computational Fluid Dynamics, Pearson Prentice Hall, latest edition. 6. MW FU, Design and Development of Metal Forming Processes and Products aided by Finite Element Simulation, Springer International Publishing AG, 2016

Revised August 2020

Subject Description Form

Subject Code	ME6603
Subject Title	Advanced Mathematics of Physics and Modern Engineering
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Prerequisite: Fundamental knowledge on single-variable and multi-variable calculus.
Objectives	The subject aims at: 1. To equip students with advanced concepts, definitions and theories of linear algebra and matrices, complex analysis and transformations, ODEs and PDEs. 2. To introduce students with advanced knowledge of engineering mathematics to various classical problems in mechanical engineering.
Intended Learning Outcomes	Upon satisfactory completion of the subject, students are expected to achieve the following outcomes: a. Understand and relating concepts of linear algebra and matrices, and be able to illustrate them using examples in their research area. b. Use the taught theories/methods to solve ODEs and PDEs from mathematical physics. c. Describe the main properties of the analytic functions and transformation methods and understand their potential applications. d. Relate the knowledge of advanced engineering mathematics to their research topics.
Subject Synopsis/ Indicative Syllabus	1. **Linear algebra and matrices:** (a) Finite dimensional transformation and matrix representations: rank, null space, inner products, adjoints, determinants, Ax=b. (b) Eigen-problems Av=λv: similarity transforamtions, diagonalization and Jordan forms. (c) Symmetric, Hermitian, orthogonal and unitary matrices; spectral decomposition. (d) Schur's therom, Gershgorin's theorem, singular value and L-U decomposition. 2. **ODEs:** (a) ODE theory: existence, uniqueness, dependence on initial data. (b) Initial value problems for linear ODEs, fundamental solution matrices and matrix exponentials; non-linear ODEs and linearization. (c) Bounary value problems, Green's functions for ODEs. (d) Green's functions for PDE boundary value problems, Posson's equation. 3. **Complex variables:** (a) Elementary functions, analytic functions, linear integrals and Cauchy's integral formula, Taylor and Laurent series, singularities and residues, Cauchy's residue theorem and contour ingerations. (b) Conformal mapping. 4. **Transform Methods:** (a) Fourier transforms, (b) Laplace transforms.

<table>
<tr><td></td><td>5. PDEs: (a) Linear, quasilinear and nonlinear PDE; classifications of 2nd order linear PDE: hyperbolic, parabolic and elliptic equations. (b) Methods of solutions: separation of variables, Fourier and Laplace transform methods, travelling waves.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>This subject will be taught via lectures, tutorials, mini-projects and case studies.

Tutorials, mini-projects and case studies will be conducted in small groups to facilitate discussions.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1. Continuous Assessment</td><td>60%</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Examination</td><td>40%</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="4"></td></tr>
</table>

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:
0.40 × End of Subject Examination + 0.60 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments, closed-book tests and projects. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. Continuous assessment will also be used to assess the students' capacities of self-learning and problem-solving and effective communication skill in English so as to fulfill the requirements of being a qualified PhD student.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>39 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Precepts or Tutorials</td><td>32 Hrs.</td></tr>
<tr><td>▪ After-class reading</td><td>34 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>105 Hrs.</td></tr>
</table>
</td></tr>
</table>

Reading List and References	1. D. A. McQuarrie, Mathematics Methods for Scientists and Engineers, University Science Books, latest edition. 2. M. Greenberg, Foundations of Applied Mathematics, Pretice Hall, latest edition. 3. R. A. Horn and C. R. Johnson, Matrix Analysis, Cambridge University Press, latest edition. 4. F. B. Hildebrand, Advanced Calculus for Applications, Prentice Hall, latest edition. 5. I. S. Sokolnikoff and R. M. Redheffer, Mathematics of Physics and Modern Engineering, McGraw Hill, latest edition.

(Implemented from 2019/20 academic year.)

March 2019